HOMEGARDENS: AGRICULTURE IN THE CITY AS AN AGROFORESTRY PRACTICE

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Abstract

Homegardens are probably the most difficult agroforestry practice to map because of their size and presence in non-agricultural areas. The LUCAS database allows to combine the “orchards” field with the “woody” component, needed to identify this agroforestry practice. The objective of this paper is to map and quantify the agroforestry homegardens in Europe by using the LUCAS database. The paper shows that Europe has 14461.04 km^2 of homegardens, 58.74% of which can be considered agroforestry as they have a woody component integrated with an agricultural product in the understory.

Keywords: LUCAS database; fruit trees homegardens; vineyards and olive homegardens; landscape features

Introduction

Homegardens identified with multi story combinations of trees and crops are usually linked to subsistence or self-consumption agriculture that are generally more complex in tropical than in temperate areas.

The Land-Cover and Land-Use Survey (LUCAS) defines kitchen gardens as “gardens, where the crops are planted heterogeneously and mainly for own consumption. These areas are mostly fenced (by metal fences or hedges) and mostly situated in residential areas or as allotment gardens” (Eurostat 2015). Homegardens are key to providing local and more sustainable healthy food while reducing the impact of agricultural activities on climate change. Homegardens can be in both rural and urban areas and are treated differently by EU policies (Mosquera-Losada et al. 2016).

When a woody component, usually fruit tree, is combined with vegetable production in the understory, homegardens are considered an agroforestry practice (Mosquera-Losada et al. 2016). Agroforestry homegardens are difficult to map because linear woody features are not registered directly in the cover databases and homegarden areas are presumably identified as a residential area due to the small size of these plots around the house.

Quantifying the extent of homegardens as an agroforestry practice at European scale is a difficult task because two layers or components are mixed: the woody component as an upperstorey and the agriculture production as a lowerstorey. For this purpose, a single database named LUCAS (LUCAS 2015), developed by Eurostat, combines coverage and use may be very useful (der Herder et al. 2016). This database is based on the visit of 340,000 points by surveyors (Eurostat 2015). LUCAS is carried out by Eurostat every three years since 2009. The last survey was run in 2015 on the mainland of European Union (EU). There are other sources such as the Corine Land Cover (CLC) that only describes coverage but not land use, therefore it is not useful to estimate the extent of agroforestry at EU level. This paper aims to quantify the presence of woody vegetation within the points classified as homegardens to provide and map this type of agroforestry practice all over EU.

Materials and methods

EU homegardens were mapped by using LUCAS survey carried out in 2015 (Eurostat 2015). LUCAS data are taken during visits by the surveyors to previously defined points in EU. Surveyors filled established forms including two questions related with the two land cover and two land uses found in each point. Data are included in a database freely available from Eurostat.

As den Herder et al. (2017) explained, by combining two covers of LUCAS, we can identify those areas of territory that have two crops at two heights. For example, while the CLC must assign a special category to the Iberian montado/dehesa without distinguishing if the lower crop is annual or pasture, LUCAS presents as a primary cover the woody element and as the secondary the lower crop. But the combination can also be made between cover and use. Thus, we can verify that a cultivation of tomatoes for example has a commercial destination or is destined for self-consumption in a home garden.

To examine the LUCAS data, we used the free software LibreOffice-Calc and QGIS 2.18. We selected the LUCAS points that were presented as primary or secondary use the value U113, identified as “Kitchen garden”, which refers to homegardens. From those points, we selected the woody covers in the primary and secondary covers fields. Woody covers were identified as the cover fields of the database named as forestry, permanent crops and other permanent crops, grassland with sparse trees or shrubs, and shrubland with sparse trees.

Based on the results of the previous exercise combining land cover and land use with the LUCAS database we mapped the whole extent of homegardens in EU (Table 1) that has a woody component, which were divided in fruit and those based on olive groves and vineyards (Table 2). The proportion of homegardens land use was estimated by dividing the total number of points identified as homegardens by the total number of points in each EU country. An estimation of the extent of homegardens per country was done by multiplying the before obtained percentage per the extension of each state (km^2).

Results

Most of homegardens are concentrated in Central and Eastern EU countries (Table 1), but also in the coastal areas of South EU Countries. Czech Republic, Slovakia and Croatia have around 1% of their land cover allocated to homegardens while France, Poland, Czech Republic, Germany, Italy and Romania have the largest area of homegardens in EU (over 1200 km^2). Few homegarden densities are found in Denmark, Finland, Ireland, Luxemburg, Malta, Sweden and United Kingdom with less than 0.1% of their total area and Cyprus, Ireland, Luxemburg and Malta with less than 15 km^2.

Table 1: Total area (km^2) and percentage of total area of homegardens and those with presence of agricultural woody cover (percentage of total homegardens) by EU member states.

Countries	Area	Homegardens		Woody cover homegardens/total homegardens	
	km^2	%	km^2	%	km^2
Austria	83944	0.36%	304.08	75.00%	228.06
Belgium	30666	0.21%	63.51	0.00%	0.00
Bulgaria	110995	0.56%	621.62	58.14%	361.41
Croatia	56539	0.99%	561.22	57.14%	320.70
Cyprus	9249	0.52%	48.34	88.89%	42.97
Czech Rep.	78874	1.61%	1270.38	90.22%	1146.1
Denmark	43162	0.08%	35.44	66.67%	23.62
Estonia	45347	0.19%	86.24	80.00%	69.00
Finland	337547	0.02%	83.97	100.00%	83.97
France	549059	0.26%	1436.22	53.17%	763.71
Germany	357745	0.38%	1372.58	73.53%	1009.25
Greece	131912	0.31%	402.78	78.95%	317.99
Hungary	93013	0.70%	648.05	44.44%	288.02
Ireland	70601	0.02%	14.43	100.00%	14.43
Italy	300576	0.51%	1541.36	59.86%	922.72
Latvia	65519	0.60%	390.14	65.63%	256.03
Lithuania	65412	0.75%	493.79	47.06%	232.37
Luxembourg	2595	0.00%	0.00		
Malta	315	0.00%	0.00		
Netherlands	37824	0.16%	60.47	25.00%	15.12
Poland	313851	0.48%	1502.46	52.73%	792.21
Portugal	88847	0.40%	355.19	22.22%	78.93
Romania	239068	0.54%	1287.39	28.89%	371.91
Slovakia	49026	1.71%	837.29	72.34%	605.70
Slovenia	20277	0.42%	84.27	75.00%	63.20
Spain	498502	0.16%	793.40	57.50%	456.20
Sweden	449896	0.02%	84.62	80.00%	67.70
UK	165152	0.08%	138.09	14.29%	19.73
EU28	4295513	0.34%	14461.04	58.74%	8493.80

Around a 60% of the total homegardens in the EU have woody cover (Table 1). Countries like Netherlands, Portugal, United Kingdom, Belgium have percentages of woody homegardens below 25% while other like Luxembourg and Malta have no woody homegardens as part of the landscape. On the contrary, there are other countries with the highest percentage of woody homegardens in EU like such as Czech Republic and Cyprus while others like Finland, Ireland, have percentages reaching almost the 100% of the homegardens with a woody component. Considering the extension Czech Republic and Germany have more than 1,000 km^2 of wooded homegarden meanwhile United Kingdom, Netherlands, Ireland and Belgium have less than 20 km^2. As show Table 2, the woody homegardens have a similar distribution than the homegardens (Table 1), with a correlation $R^2 = 0.92$.

Table 2: Total (km^2) and percentage of homegardens with presence of a woody cover and those including fruit trees and vineyards and olive by EU member states.

Countries	Fruit trees homegardens		Vineyards and olive homegardens	
	%	km^2	%	km^2
Austria	100.00%	228.06	0.00%	0.00
Belgium				
Bulgaria	92.00%	332.49	8.00%	28.91
Croatia	75.00%	240.52	25.00%	80.17
Cyprus	50.00%	21.48	50.00%	21.48
Czech Rep.	100.00%	1146.10	0.00%	0.00
Denmark	100.00%	23.62	0.00%	0.00
Estonia	100.00%	69.00	0.00%	0.00
Finland	100.00%	83.97	0.00%	0.00
France	88.06%	672.52	11.94%	91.19
Germany	100.00%	1009.25	0.00%	0.00
Greece	53.33%	169.59	46.67%	148.39
Hungary	75.00%	216.02	25.00%	72.01
Ireland	100.00%	14.43	0.00%	0.00
Italy	62.50%	576.70	37.50%	346.02
Latvia	100.00%	256.03	0.00%	0.00
Lithuania	100.00%	232.37	0.00%	0.00
Netherlands	100.00%	15.12	0.00%	0.00
Poland	100.00%	792.21	0.00%	0.00
Portugal	75.00%	59.20	25.00%	19.73
Romania	53.85%	200.26	46.15%	171.65
Slovakia	97.06%	587.88	2.94%	17.81
Slovenia	100.00%	63.20	0.00%	0.00
Spain	86.96%	396.70	13.04%	59.50
Sweden	100.00%	67.70	0.00%	0.00
UK	100.00%	19.73	0.00%	0.00
EU28	86.40%	7338.44	13.60%	1155.36

Discussion

LUCAS can be successfully used to identify agroforestry homegardens as was previously shown for general agroforestry (den Herder 2017) and hedgerows (Santiago-Freijanes et al. 2018). This is specifically important because LUCAS surveys are carried out every three years which allows policy makers and researchers to evaluate the evolution of this type of land use and to promote this type of land use in EU. Types of homegardens such as allotment gardens have been declined in the last years, but a recent renascence of this land use have been noticed (Bell et al. 2016). The large density of homegardens in central EU can be explained by the traditional use of these lands as orchards surrounding the houses. For example, different initiatives such as that developed in (i) Leipzig (Germany) where playgrounds for children were started to favour learning in conditions close to nature, that were later on used to produce food for the most disadvantaged populations or (ii) in the Czech Republic and Slovakia where homegardens were favoured during the Soviet period (Štěpánková et al. 2015), but where recently declined (Spilkova and Vágner 2016). The highest extension of homegardens in countries as France can be explained by the bigger dimension of the countries and the recent policy development.

Only a 60% of the homegardens have been identified as an agroforestry practices, however we can expect that the real figure is indeed higher. This can be explained by the fact that linear woody features (hedgerows, hedges, etc.) and isolated trees are not identified in the LUCAS database as part of the survey of LUCAS when all the points are taken. In fact, Eurostat (2015) recognizes that the plots destined for the homegarden cover often present hedgerows or fences, that are not identified. Moreover agroforestry -the integration of a woody component with vegetables or crop production- is recognized as essential to deliver ecosystem services and can be identified as a new form of agriculture (La Rosa et al. 2014) on which both public and private stakeholders are involved and acting in supporting food supply for urban and periurban areas (Duvenoy 2018).

All woody homegardens are permanent crops. The distribution between the two categories of permanent crops (fruits and olive groves / vineyards) is related with the climatic conditions and the tradition as the olive groves and vineyards are present only in Mediterranean and Medium and low Danube basins, where are typical those plantations, but another typical vine regions as the Rhin basin have not presence of this trees cover in their homegardens. This means that adequate policies should support homegarden creation and development with woody vegetation adapted to the edaphoclimatic and social conditions of the areas.

Conclusions

- Homegardens are present in most of the EU countries, but not with similar tree density.
- The distribution of wooded homegardens is very similar than the homegardens.
- Woody homegardens linked to fruit trees and vineyards/olives can be mapped by the use of LUCAS.
- There are not direct data available of linear features and isolated trees that could show a real extension of wooded homegardens in the EU, and therefore of this agroforestry practice.
- All identified wooded homegardens are linked to permanent crops.
- The distribution between the two types of permanent crops is related with climate and cropping tradition.

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